THE BRAIN’S BACK HURTS:
A NEUROSCIENCE APPROACH TO LOW BACK PAIN
The Brain’s Back Hurts
A Neuroscience Approach to Low Back Pain

More than 100 million Americans suffer from persistent pain, with epidemiological data indicating musculoskeletal pain being a large part of the pain epidemic. This increase comes with a cost in regards to healthcare utilization, prescription pain medicine overuse, professional burnout and more. The world of neuroscience, however, has allowed medicine, especially rehabilitation, to gain a greater understanding of the human pain experience. In recent years, pain neuroscience research has increasingly focused on the brain, brain plasticity, central sensitization, immune responses and more. The clinical outflow of this pain science shift has culminated in ever-increasing popular treatments such as pain science education, graded motor imagery and sensor motor retraining. These “advanced” treatments has put into question traditional treatments such as manual therapy and exercise, commonly used in rehabilitation. A deeper understanding of pain neuroscience and brain plasticity, however, implies that skillful and deliberate application of hands-on treatment and movement is a fundamental part of therapy in treating conditions such as low back pain. It can be well argued that skillful delivery of manual therapy aids in brain remapping, enhancement of endogenous mechanisms, graded exposure, cognitive restructuring of threat and more, all of which are very important in a human pain experience. In the pursuit of a bio-psycho-social approach to treat people with spinal pain, the “bio” emphasizing the biological issues of movement, tactile stimulation, blood flow, tissue health and more has seemingly been forgotten. This lecture will aim to provide a neuroscience rationale as to the mechanisms behind the efficacy of manual therapy treatments aimed at treating low back pain, thus emphasizing the need to not neglect the “bio” of the bio-psycho-social approach.

Objectives:
Upon completion of this educational session the participants will be able to:
1. Identify the magnitude of the pain epidemic on healthcare
2. Recognize the shift leaving behind the biological part of the biopsychosocial approach
3. Develop a deep understanding of the current neuroscience perspective of low back pain
4. Develop a neuroscience understanding how manual techniques enhance pain science processes in people with spinal pain
5. Apply treatment principles and approaches from the session into clinical practice

Adriaan Louw, PT, PhD
Adriaan earned both an undergraduate as well as a master’s degree in physiotherapy from the University of Stellenbosch in Cape Town, South Africa. He is an adjunct faculty member at St. Ambrose University and the University of Nevada Las Vegas, teaching pain science. Adriaan has taught throughout the US and internationally for 15 years at numerous national and international manual therapy, pain science and medical conferences. He has authored and co-authored various articles, books and book chapters related to spinal disorders and pain science. Adriaan completed his Ph.D. on therapeutic neuroscience education and is the director of Evidence In Motion’s Therapeutic Pain Specialist program.
The Brain’s Back Hurts…

Adriaan Louw, PT, PhD

>100 Million Americans have some form of persistent pain

Institute of Medicine 2012: Relieving Pain in America
US Pain Epidemic...

Global Consumption of Morphine, 2012

U.S. 78.0245

Global Mean 0.38

US Pain Epidemic...

Prescription Opioid Pain Relievers
Cocaine
Heroin

Number of Deaths


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US Pain Epidemic...MSK

Percentage of Americans Who Have a Chronic Pain Condition, by Age
- % Neck or back condition
- % Knee or leg condition
- % Other recurring pain condition

One reason...


The traditional medical model...

A

Symptoms
Pathology

B

Symptoms
Pathology

Intervention


This happens...

C

Symptoms
Pathology

This also happens (thank goodness)

![Diagram showing the relationship between symptoms and pathology]

These models are very prevalent in orthopedics

- Prevailing biomedical models focus on tissues and tissue injury.
- Orthopedic-based professions commonly use anatomy and patho-anatomy based models to explain pain to their patients.


1. Anatomy

2. Biomechanics

3. Tissue Pathology


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Research into anatomy, biomechanical and pathoanatomy models

Not only have these models shown limited efficacy in decreasing pain and disability, but they may increase fear in patients, which in turn, may increase their pain.


Lumbar Discs

• 40% of people with no back pain has a bulging disc
• Disc bulges absorb

Rotator Cuff

- 1/3 people over age 30 have abnormal findings on MRI
- 2/3 people over age 70 have abnormal findings on MRI
- After successful rotator cuff surgery 90% of people have abnormal findings on MRI


Age changes and LBP


**Knees**

- 25% to 50% of MRI’s show knee degeneration in pain-free people
- MRI scans of 35% of collegiate basketball players with no knee pain show significant abnormalities

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**In the meantime:**

The Pain Revolution...

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Education is Therapy...

In partnership with IPI
Pain is 100% from the brain...

Pain is a multiple system output, activated by an individual's specific pain neural signature.

The neural signature is activated whenever the brain perceives a threat.


Would this hurt?
What if?

Pain is a decision by the brain based on perception of...THREAT
The dichotomy...


Shift Happens....(in orthopedics)

Cyriax Mulligan Butler
McKenzie Elvey Maitland
Kalternborn Grieve

Prevalence and awareness of persistent pain

Time


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Teaching People About Pain...1998

embraced all the dimensions of pain. It was an honour to present the model, in my ‘Explaining Pain to Patients’ presentation at the International Association for the Study of Pain (IASP) world congress in Vienna in 1999.

PPA newsletter

The Physiotherapy Pain Association (for Chartered Physiotherapists)

April/May 1998

PPA members have put forward 3 proposed workshops, 2 of which have been accepted by the IASP congress committee. These are:
1. Explaining Pain to patients, family, health care professionals and employers.

Evidence Based Medicine

Louw, Puentedura, Zimney and Schmidt – Accepted for publication JOSPT March 2016
Emerging research shows that explaining to patients their pain experience from a biological and physiological perspective of how the nervous system/brain’s processes pain allows patients to move better, exercise better, think differently about pain, push further into pain, etc.

TNE Key Issue: It works!

The Efficacy of Therapeutic Neuroscience Education on Musculoskeletal Pain – An Updated Systematic Review of the Literature: Accepted for Publication Jan 2016

The results of this updated systematic review of TNE for MSK pain provides strong evidence for TNE improving:

- Pain ratings
- Pain knowledge
- Disability
- Pain catastrophization
- Fear-avoidance
- Attitudes and behaviors regarding pain
- Physical movement
- Healthcare utilization

Adriaan Louw, PT, PhD
Kory Zimney, PT, DPT
Louie Puentedura, PT, PhD
Ina Diener, PT, PhD

Pain Science...

Manual Therapy

Education only

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Pain is 100% produced by the brain...

Pain is a multiple system output, activated by an individual’s specific pain neural signature.

The neural signature is activated whenever the brain perceives a threat.


Therefore...

Altering information the brain receives (threat) can potentially alter the pain experience.

Adapted from Gifford, L.S., Pain, the tissues and the nervous system. Physiotherapy, 1996. 82: p. 27-33.
Bottom Up...

- Pain neuroscience education
- Fear Avoidance

Top-down:

- Cognitive Behavioral Therapy
Current Focus...

• Endogenous

• Neuromuscular

There is another way
Example 1


The Patients

- Five paraplegic patients
- At or below level pain for 4 years

<table>
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<tr>
<th>Subject</th>
<th>Years since injury</th>
<th>Age (years)</th>
<th>Level of lesion</th>
<th>McGill Pain Questionnaire</th>
<th>Prescribed medications</th>
<th>Non-prescribed medications</th>
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<td>26</td>
<td>T12</td>
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<td>Mean</td>
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<td></td>
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<td>8.3</td>
<td></td>
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</table>

The Treatment


The Results

Example 2


Patients/Treatment

10 right-handed patients with CRPS

Plastic Maps...


It happens fast...

Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart

A Participant’s hands placed behind screens. Opposite hand visible for Experiment 1.

B Synchronous manual brushing of real hand and rubber hand.

Sites at which skin temperature was measured.

20 - 25 cm Rubber hand
Smudging...

Complex Regional Pain Syndrome
Spinal Cord Injury
Phantom Limb Pain
Dystonia
Repetitive Strain Injuries

Somatosensory cortex
Clinical outflow...

Mirror Therapy – Phantom Limb Pain
Mirror Therapy

Shoulder

Neglect & LBP


Neglect-like tactile dysfunction in chronic back pain
“I can’t find it!”


Clinical Presentation...
Neuroplasticity: KEY ISSUE

• The CNS undergoes functional and structural changes in people with persistent pain.

• Lead to central sensitization


Research Question

If we enhanced tactile discrimination of the back, associated with brain remapping will it improve pain and spinal movement in patients with low back pain?
Sensory Discrimination vs. Integration...

Tactile discrimination, but not tactile stimulation alone, reduces chronic limb pain

G. Lorimer Moseley *, Nadia M. Zalucki **, Katja Wiech *


Case Study

- A 56-year old lady underwent discectomy for low back pain, leg pain and progressive neurological deficit.

- Measurements before, 48h postop and pre/post treatments

- The patient underwent 6 PT treatments aimed at restoring tactile acuity.
Flexion and Straight Leg Raise


Pressure Pain Thresholds

Sensory Discrimination for Chronic Low Back Pain: A Case Series


- Convenience sample of CLBP patients
  - Low back pain (Numeric Pain Rating Scale)
  - Fear-avoidance (Fear Avoidance Beliefs Questionnaire)
  - Disability (Oswestry Disability Index)
  - Spinal flexion (fingertip-to-floor)
- 5-minute localization of tactile stimuli treatment to the low back
- Immediate post-intervention
  - Pain
  - Spinal flexion.

Results: LBP immediately after GMI

Average pain rating for low back pain decreased by 1.91
Results: Flexion immediately after GMI

Average forward flexion improved by 4.82 cm

What about this?
Grade III Posterior-Anterior Mobilization in Low Back Pain...

Under Review
- Louw, A
- Farrell, K
- Beck, E
- Gillund, J
- Davis, L
- Barclay, M
- Oberhoffer, S

Grade III Posterior-Anterior Mobilization in Low Back Pain to....the Primary Somatosensory Cortex...
Preliminary Results

- 47 patients (female 26)
- 62.1 years old
- 9.58 years of LBP
- ODI 36.38
- FABQ$^\text{PA}$ 15.83
- FABQ$^\text{W}$ 18.33

Statistical significant difference in people who received the neuroscience education versus the biomechanical education to meet or exceed the MDC for SLR after treatment ($p = 0.049$)

People who received a neuroplasticity explanation for central PA mobilizations, compared to biomechanical, was 3.1 times more likely to meet or exceed the MDC for SLR after treatment.

So What?

Manual Therapy  
Education only
**TNE Key Issue: It needs movement and touch...**

**The Efficacy of Therapeutic Neuroscience Education on Musculoskeletal Pain**

— An Updated Systematic Review of the Literature (submitted for publication)

- Mobilization and manipulation
- Soft tissue massage
- Muscle and neural mobilization
- Trunk stabilization
- Circuit based aerobic exercise
- Movement exercises
- Pacing of ADLs
- Graded exposure with ADLs
- Trigger point dry needling
- Neck stabilization exercises
- Aquatic exercise program

In all but one of these studies did patients have statistically significant (p<0.05) decrease in pain ratings

The other group: NONE

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So What?

- Top down before bottom up
- Top down while bottom up

I have not changed the manual therapy techniques I use, I changed:
- The way I explain them
- How I see them work
Thank you & acknowledgements...

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- Colleen, Hailey and Samuel Louw
- Ina Diener
- Louis Gifford
- Louie Puenteedura
- John Childs
- Tim Flynn
- Lorimer Moseley
- David Butler
- Merrill Landers
- Kory Zimney
- Steve Schmidt
- ISPI staff and faculty
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References